Big Swingers Save Shoulders in Serving

A better understanding of the physical demands of the tennis serve on the whole body will help sports physicians and other health professionals work out more effective ways to prevent and treat the shoulder and elbow injuries commonly suffered by elite level players.

This advice by Australian and American researchers is contained in a report of a study of centre court matches at the Sydney Olympics featured in a special tennis issue of the *Journal of Science and Medicine in Sport* to be published shortly by Sports Medicine Australia (SMA).

The study was carried out into the effects on shoulder and elbow joints of two variations in service technique – the full and abbreviated backswing and the deeper versus minimal knee bend.

The upper limb is subject to high loads in the service action, the paper points out, a movement which, if repeated many times, can cause injury.

Training should ensure that the muscles surrounding shoulder and elbow joints are strengthened both in eccentric and concentric movement patterns to help protect the region from injury but it should be stressed that physical preparation must encompass all sections of the body that play a role in the kinetic chain.

"Male players commonly recorded higher torques and forces at the shoulder and elbow joints than their female counterparts. These higher kinetic measures are an important factor in producing the significantly higher service velocity for this group of players.

"Subjects with a smaller front knee flexion and thus lesser 'leg-drive' also loaded the shoulder and elbow joints with larger torques, particularly when the arm was maximally externally rotated.

"Players should therefore develop an effective 'leg-drive' during the service action to attain high velocities with as small a loading profile as possible. This requires that players flex the knee joint during the backswing phase of the service action, prior to rapidly extending during the drive to impact.

"While those with an abbreviated swing recorded a similar service velocity and upper limb torques to those who used a full swing, minor differences were recorded in the force profile at the shoulder," the paper says.

"A trend of higher anterior shoulder force and the general trend of forces and torques for both groups would indicate that the full swing may be a preferred service technique from a loading perspective."

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Abstract

Technique Effects on Upper Limb Loading in the Tennis Serve

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The purpose of this study was to compare the shoulder and elbow joint loads during the tennis serve. Two synchronised 200 Hz video cameras were used to record the service action of 20 male and female players at the Sydney 2000 Olympics. The displacement histories of 20 selected landmarks, were calculated using the direct linear transformation approach. Ball speed was recorded from the stadium radar gun. The Peak Motus system was used to smooth displacements, while a customised inverse-dynamics program was used to calculate 3D shoulder and elbow joint kinematics and kinetics. Male players, who recorded significantly higher service speeds (male =183 km hr^{-1}: female = 149 km hr^{-1}) recorded significantly higher normalised and absolute internal rotation shoulder torque at the position when the arm was maximally externally rotated (MER)(male = 4.6% and 64.9 Nm: female = 3.5% and 37.5 Nm). A higher absolute elbow varus torque (67.6 Nm) was also recorded at MER, when compared with the female players (41.3 Nm). Peak normalised horizontal adduction torque (male = 7.6%: female = 6.5%), normalised shoulder compressive force (male = 79.6%: female = 59.1%) and absolute compressive force (male = 608.3 N: female = 363.7 N), were higher for the male players. Players who flexed at the front knee by 7.6°, in the backswing phase of the serve, recorded a similar speed (162 km hr^{-1}), and an increased normalised internal rotation torque at MER (5.0 %), when compared with those who flexed by 14.7°. They also recorded a larger normalised varus torque at MER (5.3% v 3.9%) and peak value (6.3% v 5.2%). Players who recorded a larger knee flexion also recorded less normalised and absolute (4.3%, 55.6 Nm) peak internal rotation torque compared with those with less flexion (5.6%, 63.9 Nm). Those players, who used an abbreviated backswing, were able to serve with a similar speed and recorded similar kinetic values. Loading on the shoulder and elbow joints is higher for the male than female players, which is a reason for the significantly higher service speed by the males. The higher kinetic measures for the group with the lower knee flexion means that all players should be encouraged to flex their knees during the backswing phase of the service action. The type of backswing was shown to have minimal influence on service velocity or loading of the shoulder and elbow joints.